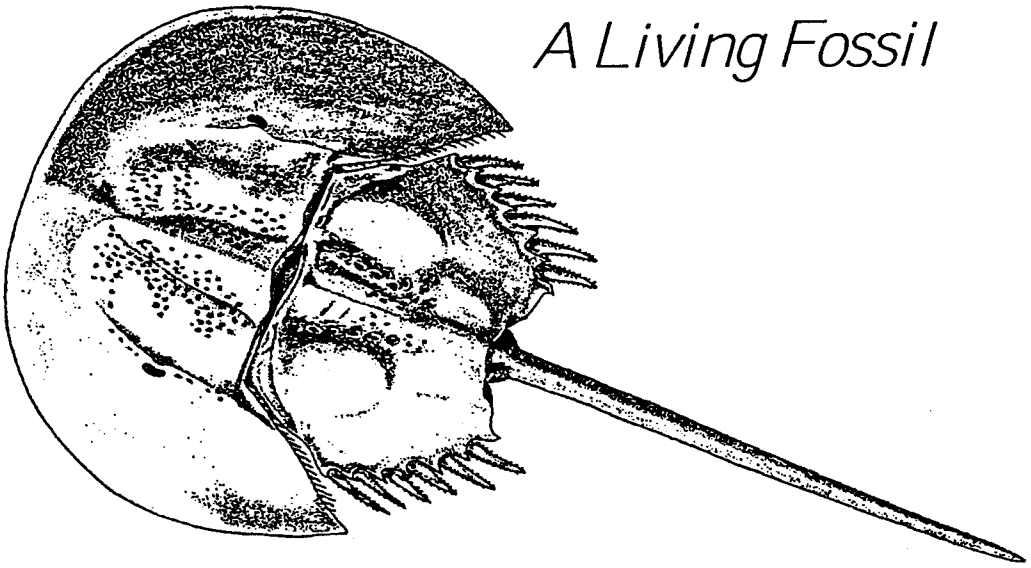
U.S. Fish & Wildlife Service

The Horseshoe Crab

A Living Fossil



An Ancient Ritual

During early spring, a female horseshoe crab 50 miles offshore on the continental shelf becomes more active. She emerges from the muddy bed where she has spent most of the winter. Her primitive biological clock tells her to begin her yearly journey, to take part in a ritual that has been repeated for more than 350 million years.

By May, this horseshoe crab will join a massive gathering of horseshoe crabs waiting in the shallows of Delaware Bay for the right moment to crawl ashore and spawn. During full-moon high tides in late April through June, she and millions of other horseshoe crabs will lay and fertilize billions of pale green eggs on Delaware and New Jersey beaches. By the end of May, some beaches will be literally awash in the tiny eggs. Most males and females return to the bay before the tide recedes, but many become stranded on the beach, some upside down. Although many will die, horseshoe crabs can survive as long as four days out of the water if their primitive "book gills" are kept moist. When the crabs are buried in moist sand or are in a folded position, moisture is conserved.

Life History

An adult female horseshoe crab measures 11 inches across and can carry 88,000 eggs. She digs down into the sand or peat about 6 to 8 inches and lays clutches of eggs that become mixed with sand grains. Then she drags the male across the eggs, and he fertilizes them. Newly laid eggs are soft and sticky. The coat of the egg hardens in contact with seawater.

A typical egg cluster, about the size and shape of a flattened golf ball, contains about 4,000 eggs.

Within a few days, a new egg coat, a transparent, spherical capsule formed by the embryo, swells and bursts the old egg coat. Inside this sphere, all embryonic development can be easily seen. At the next full-moon high tide, the eggs will hatch. The tailless larvae will molt at least six times in the first year. It will be at least nine years before the young horseshoe crabs reach sexual maturity. They may live as long as 15 to 20 years.

Because horseshoe crabs do not breed until they reach 9 or more years of age, effects on populations may not be apparent immediately. For example, if an entire generation of larvae were wiped out by an oil spill, populations might not show dramatic declines until the generation would have reached sexual maturity nine years later.

The horseshoe crab is not actually a true crab, but is a member of an ancient group of arthropods, more closely related to spiders and scorpions, which predate dinosaurs by 250 million years. Horseshoe crabs are evolutionary survivors. They have changed little since they adapted superbly to their environment early in the history of life on earth.

Horseshoe crabs have several pairs of eyes. Their large compound eyes are sensitive to polarized light and can magnify sunlight 10 times. A pair of simple eyes on the forward side of the carapace (shell) can sense ultraviolet light from the moon.

In addition, five eye spots are located under the carapace, with more on the underside of the tail. Horseshoe crabs occasionally swim upside down and may once have used these eyes more than they do today.

Horseshoe crabs have no jaws or teeth. Instead, an impressive array of mouth bristles at the bases of five pairs of legs maneuver food items such as small clams and sea worms into the centrally located mouth. To chew its food, the crab must simulate walking movements.

The Fragile Connection

The largest population of horseshoe crabs anywhere in the world is found in Delaware Bay. On June 8, 1990, the spawning population on the beaches of Delaware Bay was estimated to be 1.24 million.

Delaware Bay also hosts the second largest population of migrating shorebirds in North America. Only three other areas from the Arctic to the Antarctic are used by the birds in the Atlantic Flyway, and all four areas are linked together like a chain. If one link is destroyed, the entire chain is

threatened. More than 1 million shorebirds fly nonstop from places as far away as Peru, Suriname and Argentina's Tierra del Fuego - as much as 5,000 miles. About half the total population of red knots - 100,000 - depend upon Delaware Bay's horseshoe crab eggs as a protein-rich food supply. Hundreds of thousands of other migratory birds representing several species also converge here in the last 10 days of May.

Every year nature provides an incredible spectacle in mid-May as these ravenously hungry birds start arriving. They will double their weight in less than two weeks by eating thousands of horseshoe crab eggs per bird. Then they will fly on to their summer breeding grounds in the Arctic.

Up to 80 percent of the entire hemispheric populations of some shorebirds pass through this critical staging area. For three weeks in the spring, these shorebirds have all their eggs in one basket. An environmental catastrophe such as an oil spill in Delaware Bay could completely wipe out some populations of these shorebirds.

In addition to providing the principal food source for migratory birds in Delaware Bay, horseshoe crabs themselves comprise the main diet of juvenile loggerhead turtles, particularly in Chesapeake Bay. Loggerhead turtles are protected as threatened by the Endangered Species Act.

The Medical Connection

Of all marine species, horseshoe crabs have contributed the most to medical and physiological research. Most of what we know about human vision was drawn from a Nobel Prize-winning scientist's work with cells in horseshoe crab eyes. Studies on the long single cell of the horseshoe crab's optic nerve helped establish the field of neurobiology. Important progress has been made toward understanding diseases such as arthritis, cancer, arteriosclerosis, schizophrenia, AIDS and Alzheimer's because of research on horseshoe crab cells.

The straw-colored, copper-based horseshoe crab blood turns blue when exposed to high concentrations of oxygen. Instead of many types of blood cells, horseshoe crabs have primitive large blood cells called amoebocytes.

Research on these cells has played a crucial role in unraveling the mysteries of how higher mammals fight disease. A clotting agent called Limulus Amoebocyte Lysate in the amoebocytes can differentiate between bacterial and viral meningitis. Normal testing time for this acute disease is 48 hours, but LAL cuts it down to 15 minutes. All drugs manufactured by pharmaceutical companies are tested for contamination by bacterial toxins using LAL.

Surgical sutures and wound dressings made with a pure form of the shell material of horseshoe crabs, speeds healing by 35 to 50 percent.

Threats to Survival

Once numerous in Japan, the horseshoe crab species found there *(Tachypleus tridentatus)* is considered endangered primarily because of increasing human population, industrialization and bulkheading (diking and filling of beaches). This has destroyed much of the spawning habitat. Japan has declared this species a national treasure. The sight of a single pair of mating horseshoe crabs in areas where they were abundant is rare.

Similar threats confront horseshoe crabs in the Delaware Bay. Human disturbance can adversely affect the spawning activities. Recreational vehicle traffic on beaches can crush the crabs as well as destroy their habitat. Threats are also posed by potential oil spills from barges or tankers. These human activities not only harm the crabs but also can interfere with feeding and resting activities of millions of migrating shorebirds at a critical time in their lives.

In addition to habitat loss, the increasing harvest of horseshoe crabs may be seriously reducing the population.

The Protection Connection

The Atlantic States Marine Fisheries Commission is developing a plan for conservation and management of horseshoe crabs including regulation of their harvest.

The New Jersey Division of Fish, Game and Wildlife and the Delaware Department of Natural Resources and Environmental Control have licensing programs to regulate the commercial harvesting of horseshoe crabs to protect the crabs pending Commission plan completion.

Peak spawning times, weather permitting, usually coincide with the peak tides in mid to late May. To learn more about these animals, volunteers help count adult horseshoe crabs on the beaches at spawning time. From that information biologists estimate the total population. Researchers are working to improve the method of estimating the population.

Often we learn the value of a species after its population is decimated. However, we know how valuable horseshoe crabs are now, and we have the opportunity to manage and protect present populations for the future.

For additional information contact:

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Cape May Bird Observatory
609/884 2736

New Jersey Division of Fish,
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609/292 9400

Delaware
U.S. Fish & Wildlife Service
Bombay Hook National Wildlife Refuge
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Prime Hook National Wildlife Refuge
302/684 8419

Delaware Department of Natural
Resources and Environmental Control
302/739 4506

For a copy of the Delaware Viewing Guide call: 302/739 5297

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